

### **REMARKS**

This responds to the Office Action mailed on March 11, 2005.

Claims 3, 6, 7, 9, 11-15, 17, 18, 20-23, 25, 27, 29, 37, 39, and 40 are amended, claims 4, 8, 30-35, and 38 are canceled, and claims 42-46 are added; as a result, claims 3, 6, 7, 9, 11-29, 36, 37, and 39-46 are now pending in this application.

#### **Claim Amendments**

Claims 3, 11 and 23 were amended to further distinguish over the cited documents. Claim 3 was amended to include features of canceled claim 8. Support for amendments to claims 11 and 23 can be found *inter alia* in the Instant Application at Page 9, Lines 21-23.

Claims 6, 7, 9, 12, 13, 15, 17, 18, 20-22, 25, 27, 29, 37, 39 and 40 were amended to correct grammatical errors and not for reasons of patentability.

#### **Request for a Telephone Interview**

Applicant requests that the Examiner contact Andrew DeLizio at 281-213-8980 to schedule a telephonic interview before taking further action on this patent application.

#### **35 USC §102**

The Office Action rejected claims 16, 17, 20-22 and 36 under 35 USC §102 as being anticipated by Calder et al. ("Value Profiling and Optimization", Journal of Instruction-Level Parallelism, 1999; hereinafter referred to as Calder).

Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration. *In re Dillon* 919 F.2d 688, 16 USPQ 2d 1897, 1908 (Fed. Cir. 1990) (en banc), cert. denied, 500 U.S. 904 (1991). It is not enough, however, that the prior art reference discloses all the claimed elements in isolation. Rather, "[a]nticipation requires the presence in a single prior reference disclosure of each and every element of the claimed invention, *arranged as in the claim.*" *Lindemann Maschinenfabrik GmbH v. American Hoist &*

*Derrick Co.*, 730 F.2d 1452, 221 USPQ 481, 485 (Fed. Cir. 1984) (citing *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 220 USPQ 193 (Fed. Cir. 1983)) (emphasis added).

Applicant respectfully submits that the Office Action does not establish a *prima facie* case of anticipation because the reference does not teach each and every element of the rejected claims.

#### *Discussion of Claim 16*

Claim 16 recites, “instrumenting the software program to, when executed, sample a location-value **every S occurrences** of the candidate load instruction, wherein **S is an integer greater than 1.**” (Emphasis added.) The Office Action asserts that Calder (page 20, first full paragraph and page 32, section 8.2, last paragraph) discloses the claimed “every S occurrences... wherein S is an integer greater than 1.” Applicant respectfully submits that the Office Action has mischaracterized Calder. Although the cited passage mentions random sampling, Calder’s random sampler samples **every occurrence** of the instruction for a given time interval. Calder’s “random sampler continuously samples instructions for a given time interval, and then backs off for a random amount of time, and then samples again.” Calder page 32, section 8.2, first paragraph. For at least this reason, Applicant respectfully submits that Calder does not teach or suggest each and every element of claim 16.

#### *Discussion of Claims 17, 20-22, and 36*

Claims 17, 20-22, and 36 each depend, directly or indirectly, on claim 16. For at least the reasons noted above, Applicant respectfully submits that Calder does not teach or suggest each and every element of claims 17, 20-22, and 36.

#### 35 USC §103

The Office Action rejected claims 3, 6-9, 11, 12, 14, 15, 24, 25, 28, 30, 31, 33, 35, 37, 38 and 40 as being obvious in light of Connors et al. (“Compiler-Directed Dynamic Computation Reuse: Rationale and Initial Results”, Proceedings of the 32nd Annual International Symposium on Microarchitecture (MICRO), 1999; hereinafter referred to as Connors) in view of Feller et al. (“Value Profiling”, IEEE, 1997; hereinafter referred to as Feller) and in further view of Keller et

al. (U.S. 5,355,487; hereinafter referred to as Keller). Applicants respectfully traverse this rejection because the Office Action has not established a *prima facie* case of obviousness.

In order for the Examiner to establish a *prima facie* case of obviousness, three base criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *M.P.E.P.* § 2142 (citing *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed.Cir. 1991)).

#### *Discussion of Claims 3 and 9*

Claim 3 recites: 1) "tracking, during the execution, a number of times a set-value is encountered" and 2) "selecting, based on the tracking, the candidate reuse region as a computation reuse region." The Office Action believes that Connors teaches these features in its Abstract (page 158) and its Section 3.1 (pages 162-163). See Office Action at page 5. The following discussion will show how the cited passages do not teach or suggest the claim features noted above.

Neither of the cited passages teaches or suggests tracking a number of times a set-value is encountered, as recited in claim 3. In particular, Connors' Abstract does not describe anything close to these claims features, while Section 3.1 describes a "computation reuse buffer." The computation reuse buffer is for recording information associated with a region of code and for "detecting the situation in which all of the input information to the region is recurrent." Connors at page 162, Section 3.1. Each entry of the computation reuse buffer "is responsible for recording computation information for future executions. As such, each entry contains four fields: 1) the computation tag; 2) a valid bit indicating whether the entry currently contains a valid computation; 3) an array of computation instances; and 4) a Least Recently Used (LRU) information array for managing the replacement of the computation instances." *Id.* None of these fields are for tracking a number of times a set-value is encountered. Therefore, while the computation reuse buffer can determine whether a code region's set of input registers is recurrent, the buffer does not track a number of times a set-value is encountered.

Additionally, neither of the cited passages teaches or suggests “selecting, based on the tracking, the candidate reuse region as a computation reuse region.” As noted above, the cited passages do not teach the claimed “tracking,” so as a result, the cited passages do not teach or suggest selecting candidate reuse regions based on the tracking recited in claim 3.

For the combination of Connors, Feller, and Keller to teach or suggest the noted claim feature, Keller, and/or Feller must teach what Connors is lacking. The Office Action has not identified any passage in Keller or Feller that teaches or suggests the above-noted claim features. As such, Applicant respectfully submits that the combination of Connors, Feller, and Keller does not teach or suggest each and every element of claim 3.

Claim 9 recites a machine-readable medium including instructions that cause a machine to perform the method recited in claim 3. For the reasons noted above vis-à-vis claim 3, Applicant submits that the cited combination does not teach or suggest all the features of claim 9.

#### *Discussion of Claim 11*

The Office Action asserts that claims 11 and 12 include features similar to those recited in claims 23 and 24. Applicant submits claims 11 and 12 are distinct from claims 23 and 24.

Claim 11 recites, “combining the register values into a single set-value; determining an occurrence frequency of the single set-value; and storing the occurrence frequency and the single set-value in a data structure.” Applicant submits that Connors’ computation reuse buffer does not does not teach or suggest these claim features. Furthermore, the Office Action has not identified a passage in the cited combination that teaches the above-noted claim features, and Applicant knows of no such passage.

#### *Discussion of Claims 6, 7, 12, 14, and 15*

Each of claims 6, 7, 12, 14, and 15 depend, directly or indirectly, on one of claims 3, 9, or 11. For at least the reasons noted in the discussions of claims 3, 9, and 11, Applicant submits that the combination of Connors, Feller, and Keller does not teach or suggest each and every element of claims 6, 7, 12, 14, and 15.

*Discussion of Claims 24, 25, and 28*

Each of claims 24 and 25 depend, directly or indirectly, on claim 23. Claim 23 recites, “periodically sampling set-values for ones of the candidate reuse regions to produce a probability of occurrence of top set-values, wherein each of the set-values includes values of input registers for one of the candidate reuse regions; and basing the selection of the reuse regions on the probability of occurrence of the top set-values. Applicant submits that Connors’ computation reuse buffer does not does not teach or suggest these claim features. Furthermore, the Office Action has not identified a passage in Connors, or the other references of the cited combination, that teaches or suggests the above-noted claim features, and Applicant knows of no such passage.

Claim 28 recites a machine-readable medium including instructions that cause a machine to perform the method recited in claim 23. For at least the reasons noted above vis-à-vis claim 23, Applicant submits that the cited combination does not teach or suggest all the features of claim 28.

*Discussion of Claims 8, 30, 31, 33, 35, and 38*

Applicant has canceled claims 8, 30, 31, 33, 35, and 38.

*Discussion of Claims 40*

The Office Action asserts that claim 40 includes features similar to those recited in claim 24. Applicant submits claim 40 is distinct from claims 24. Claim 40 depends on claim 39. Claim 39 recites, “the computation reuse region is selected based on an occurrence frequency of the set-values.” Applicant submits that Connors’ computation reuse buffer does not does not teach or suggest these claim features. Furthermore, the Office Action has not identified a passage in Connors, or the other references of the cited combination, that teaches or suggests the above-noted claim features, and Applicant knows of no such passage.

The Office Action rejected claims 4, 32, and 41 as being obvious in light of Connors et al. in view of Feller et al. and in further view of Keller et al. and in further view of “Dictionary of Computing” (1996).

*Discussion of Claim 4*

Claims 4 depends on claim 3. For the combination of Connors, Feller, Keller and “Dictionary of Computing” to teach or suggest each and every element of claim 4, “Dictionary of Computing” would have to teach or suggest what Connors, Feller, and Keller are missing. Applicant submits that “Dictionary of Computing” does not teach or suggest the claimed “tracking, during execution, a number of times a set-value is encountered; and selecting, based on the tracking, the candidate reuse region as a computation reuse region.” For at least this reason, Applicant submits that the combination of Connors, Feller, Keller and “Dictionary of Computing” does not teach or suggest each and every element of claim 4.

*Discussion of Claim 32*

Applicant has canceled claim 32.

*Discussion of Claim 41*

Claim 41 indirectly depends on claim 39. Claim 39 recites, “the computation reuse region is selected based on an occurrence frequency of one or more of the set-values.” Applicant submits that Connors’ computation reuse buffer does not does not teach or suggest these claim features. Furthermore, the Office Action has not identified a passage in Connors, Feller, and Keller that teaches or suggests the above-noted claim features, and Applicant knows of no such passage. For the cited combination to teach or suggest each and every element of claim 41, “Dictionary of Computing” would have to teach or suggest what Connors, Feller, and Keller are missing. Applicant submits that “Dictionary of Computing” does not teach or suggest the above-noted claim feature. For at least this reason, Applicant submits that the combination of Connors, Feller, Keller, and “Dictionary of Computing” does not teach or suggest each and every element of claim 41.

The Office Action rejected claims 13 and 34 as being obvious in light of Connors in view of Feller and in further view of Keller, in further view of Chang (U.S. 5,933,628; hereinafter referred to as Chang) and in further view of APA (unchallenged former Official Notice).

### *Discussion of Claim 13*

Claim 13 indirectly depends on claim 11. Claim 13 includes, “combining the register values into a single set-value; determining an occurrence frequency of the single set-value; and storing the occurrence frequency and the single set-value in a data structure.” As noted above, Connors, Keller, and Feller do not teach or suggest all the elements of claim 11. For the combination of Connors, Feller, Keller, Chang, and APA to teach or suggest each and every element of claim 13, Chang and/or APA would have to teach or suggest the above-noted claim feature. Applicant submits that neither Chang nor APA teach or suggest the above-noted claim feature. For at least this reason, Applicant submits that the combination of Connors, Feller, Keller, Chang, and APA does not teach or suggest each and every element of claim 13.

### *Discussion of Claim 34*

Applicant has canceled claim 34.

The Office Action rejected claims 18 and 19 as being obvious in light of Calder in view of Chang.

### *Discussion of Claims 18 and 19*

Each of claims 18 and 19 depend, directly or indirectly, on claim 16.

As discussed above, claim 16 recites, “instrumenting the software program to, when executed, sample a location-value every S occurrences of the candidate load instruction, wherein S is an integer greater than 1.” Calder’s sampling differs from that recited in claim 16. Calder’s “random sampler continuously samples instructions for a given time interval, and then backs off for a random amount of time, and then samples again.” Calder page 32, section 8.2, first paragraph. As such, Calder does not teach or suggest all the elements of claims 16 and its dependent claims. For the combination of Calder and Chang to teach or suggest each and every element of claims 18 and 19, Chang would have to teach or suggest what Calder are missing. The Office Action has not identified a passage in Chang that teaches the above-noted claim feature. For at least this reason, Applicant submits that the combination of Calder and Chang does not teach or suggest each and every element of claims 18 and 19.

The Office Action asked Applicant to show that claims 23, 26, 27, 29, and 39 are not obvious in light of Connors in view of Feller.

*Discussion of Claims 23, 27, and 39*

Claim 23 recites, “periodically sampling set-values for ones of the candidate reuse regions to produce a probability of occurrence of top set-values, wherein each of the set-values includes values of input registers for one of the candidate reuse regions; and basing the selection of the reuse regions on the probability of occurrence of the top set-values. Applicant submits that Connors’ computation reuse buffer does not does not teach or suggest these claim features.

The Office Action also asserts that the passage in Connors at page 165, second column, third paragraph, teaches the above-noted claim features. However, Applicant submits that this passage does not relate to sampling set-values. Instead, the passage describes tracking how many times an instruction is executed in proportion to all other executed instructions. Connors states, “An instruction is considered reusable if the weight of the top  $k$  recorded executions detected during profiling account for a large fraction of the instruction execution... Essentially instruction-level profiling information is used to find the individual repeating instructions and to construct large regions of potential reuse in a bottom-up fashion.” Connors at page 165, second column, third paragraph. While Connors’ builds reuse regions by profiling the number of times an instruction is executed, Claim 23 selects reuse regions by “periodically sampling set-values for ones of the candidate reuse regions to produce a probability of occurrence of top set-values.”

The Office Action has not identified a passage in Feller that teaches or suggests what Connors is lacking. As such, Applicant submits that claim 23 is allowable over the cited combination.

Claims 27 and 39 also recite using an “occurrence frequency” for selecting computation reuse regions. For at least the reasons noted in the discussion of claim s3, Applicant submits that the combination of Connors and Feller does not teach or suggest each and every element of claims 27 and 29.

*Discussion of Claims 26 and 29*



Each of claims 26 and 29 depend, directly or indirectly, on one of claims 23 or 27. For at least the reasons noted in the discussion of claims 27 and 29, Applicant submits that the combination of Connors and Feller does not teach or suggest each and every element of claims 26 and 29.

*Reservation of Rights*

Applicant does not admit that documents cited under 35 U.S.C. §§ 102(a), 102(e), 103/102(a), or 103/102(e) are prior art, and reserves the right to swear behind them at a later date. Arguments presented to distinguish such documents should not be construed as admissions that the documents are prior art. Applicant also reserves the right to pursue canceled and originally filed claims in a continuation application. Furthermore, Applicant does not acquiesce to any of the Examiner's assertions about the claims or the cited documents and reserves the right to argue these assertions in the future.

Conclusion

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney, Andrew DeLizio (281-213-8980), or Applicant's below-named representative to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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